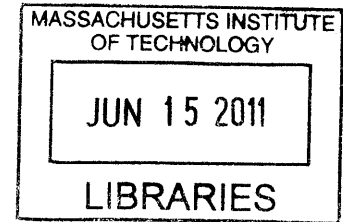


# **Risk Warehousing within Insurance Firms and the Role of Securitization**

by  
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B.Bus.Sc. in Actuarial Science  
University of Cape Town, 1997



**ARCHIVES**

Submitted to the MIT Sloan School of Management in partial fulfilment  
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## **Abstract**

Insurance firms perform two key economic functions. First, they intermediate risk by marketing, selling and administering insurance policies. Second, they warehouse the risks underlying those policies. If viewed as separate businesses, intermediation and warehousing have very different risk profiles and characteristics. While intermediation is a function essential to the firm's role, the warehousing of those risks is mostly optional. It involves deciding to retain risks for the insurance firm's account rather than hedge the risk and thereby pass it on to a third party. The decision to retain or hedge risks is critical to a firm's financial outcomes.

Insurance risks include underwriting factors like longevity, mortality and exposure to natural disasters. They also include economic factors like interest rates, currencies, counter-party default and equity markets. The consensus in the academic theory is that since insurance firms face significant frictional costs in raising capital, value-maximising firms will hedge all risks where the spread costs of the hedging instrument are low. This would seem to include most or all economic risks.

As for underwriting risks, where hedging spreads are high, the decision will be a trade-off. The firm will weigh up the reduced Risk-Bearing Costs offered by the hedging counter-party versus the Risk Transfer Costs incurred in these transactions.

In practice it seems many firms hedge less than might be expected, retaining more economic and underwriting risk than may be explained by the theory. Factors which may be driving a bias towards risk are briefly explored, including regulatory drivers and an expectation of beating the market.

Insurance-linked securitization offers benefits as a means of hedging risk and enhancing shareholder value through reduced Risk-Bearing Costs, although it faces informational problems that increase Risk Transfer Costs. Catastrophe Risk Bonds appear to have achieved a critical mass on the back of some historical capital shortages in the reinsurance industry. The life insurance securitization market could be poised for growth, but based on the history of Catastrophe Risk Bonds it may also require capital shortages in the life industry as a catalyst. Regulatory capital requirements will play a pivotal role in this regard.

Thesis Supervisor: S.P. Kothari

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## **Chapter 1**

### **Economic Functions of Insurance Firms: Intermediation versus Warehousing**

While the concept of insurance probably extends well back to many contexts in earlier civilizations, an intuitive way to think about its early development is to consider the problem of the principal in sea-faring trade. Since a principal would invest a substantial sum in a given voyage, an uninsured venture was rather risky. If a ship returned successfully from a trading voyage there would be a handsome return, but if it was lost at sea then all the financial outlay was lost with it. Insurance pioneers would have understood that while a given ship has this risk profile, a larger spread of exposures amongst multiple ships would give a much more stable outcome. It therefore makes sense for risk averse principals either to pool their interests across ships (in this example), or to be insured with a non-principal who would himself spread his risk across multiple customers.

#### **Mutual versus Proprietary Structures**

This example illustrates not only risk diversification but also mutuality. Mutuality refers to the sharing of risk among principal risk-bearers. This form survives today in so-called mutual insurance firms. Such firms do not have equity shareholders, but rather are managed for the benefit of policyholders, who are both customers and the firm's residual claimants.

An alternative form of the insurance firm is the proprietary structure, where policyholders are insured on defined contract terms, independent of the overall experience of the firm, and do not benefit from any residual surplus. The surplus instead goes to equity shareholders.

In the last number of years many historically mutual firms have chosen to convert to the proprietary form, which involves allocating shares to policyholders at a point in time. Two of the highest profile examples of this conversion in the United States were Prudential of America Group in 2001 and Metropolitan Life in 2002.

## **Intermediation versus Warehousing**

Merton and Perold (1999) introduce the concept of principal activities for financial firms as a distinct focus separate from other non-principal activities. Turning to insurance firms specifically, Cowley and Cummins (2005) describe this distinction as being between two key economic activities, namely *Intermediation* and *Warehousing*.

Intermediation refers to the process of marketing, selling and administering insurance policies. It involves managing distribution channels, whether telephone-, internet- or agent-based. It also requires screening applicants, managing contractual documentation, answering customer queries, collecting premiums and assessing and paying claims. It results in the transfer of risk from the customer to the insurance firm.

Warehousing refers to the function of acting as financial principal or risk-bearer in the insurance contract. If claims experience is adverse it requires using equity shareholder capital to pay claims.

The cash flows and profits of any insurance firm can by definition be divided into these two activities. In the proprietary form, customers are typically most aware of the firm's intermediation activities. Their interest in warehousing activities would typically not extend beyond the requirement that the firm have acceptable creditworthiness to give sufficient assurance that claims will be paid when due. Shareholders on the other hand will be deeply interested in both, since both ultimately affect the residual surplus of the firm. The same is true of policyholders in the mutual form.

For most insurance firms their published data do not separate the revenues and profits emerging from intermediation versus warehousing. To do so would require modelling what the profits of the firm would have been if it had hedged all the risks it had intermediated on the best terms available in the market. The profits after these notional hedging costs would then be attributable purely to intermediation. The difference between the intermediation profits and actual reported profits would then be the balance due to warehousing. The intermediating firm itself may of course be best placed to warehouse a given risk, in which case the internal costs of hedging need to be priced on commercial terms and included in the notional hedging costs.

Looking at the granular policy level, one might consider that every premium has a component that reflects only the expected future claims under the policy (the actuarially fair premium). If one then adds on the spread costs of the most efficient hedging mechanism available one would have the total amount of the premium relating to warehousing. The balance (including any fees or charges) must relate to intermediation.

This distinction between intermediation and warehousing applies regardless of the type of insurance business conducted. Some types of contracts, for example life insurance contracts, may require more intensive screening to counter the effects of adverse-selection, as well as face-to-face advisory services. This is a complex and costly intermediation function. Simple auto insurance on the other hand may be intermediated with very low marginal costs online. Regardless, both firms have engaged in intermediation and will achieve intermediation profits commensurate with how well they have served customer needs.

The best contrast of these activities would be to compare a life insurer who offers pure savings products (like mutual funds) with a hurricane reinsurer. The former will carry no risk as a principal (except credit risk) since the customer receives only the return of the investment portfolio. It is therefore almost purely engaged in intermediation. The hurricane reinsurer in contrast will offer “wholesale” insurance to other firms who have risks associated with hurricanes and wish to hedge those risks. It will be primarily engaged in warehousing.

In order to illustrate this critical functional distinction we look at a simple insurance policy and disaggregate the cash flows between intermediation and warehousing. The insurance policy in question has a term of 5 years, a regular premium of \$600 paid annually upfront, and an expected claim at the end of 5 years of \$3000. The insurance firm incurs expenses of \$200 at policy inception and then \$50 for each of the remaining 4 years after that. Looking at the insurance firm in total generates the cash flow profile in Table 1A.



**Table 1A: Insurance Cash Flow Example - Total Firm**

Time	Premium	Expenses	Expected Claim	Net Cash Flow
0	600	-200		400
1	600	-50		550
2	600	-50		550
3	600	-50		550
4	600	-50		550
5	0	0	-3000	-3000

Source: Author

From a profitability perspective, assuming a discount rate of 10% per annum, the total firm's cash flow profile has a net present value at time 0 of \$280.66. However, in order to understand the performance of the firm better, one needs to break these cash flows into the two activities, intermediation and warehousing. To do this, we calculate the component of the premium that is actuarially equivalent to the expected cost of the claim. At a discount rate of 10% per annum, \$447 equates to the cost of the claim on a present value basis. To hedge this risk in the market one would expect to pay a spread cost above the actuarially equivalent value. For simplicity we assume spread costs of \$13 to give a total warehousing premium of \$460.

We also have to divide the expenses of the firm between its intermediation and warehousing activities. For most firms one would expect intermediation to make up the largest component of its expenses, so we assume warehousing expenses to be zero in this case. This generates the cash flow profiles for warehousing (Table 1B) and intermediation (Table 1C) respectively, along with a division of the firm's net present value.

**Table 1B: Insurance Cash Flow Example - Warehousing Only**

Time	Total Premium	Expenses	Expected Claim	Net Cash Flow
0	460	0		460
1	460	0		460
2	460	0		460
3	460	0		460
4	460	0		460
5	0	0	-3000	-3000
<i>Present Value of Policy</i>	<b>55.37</b>			

Source: Author

**Table 1C: Insurance Cash Flow Example - Intermediation Only**

Time	Total Premium	Expenses	Expected Claim	Net Cash Flow
0	140	-200		-60
1	140	-50		90
2	140	-50		90
3	140	-50		90
4	140	-50		90
5	0	0		0
<i>Present Value of Policy</i>	<b>225.29</b>			

Source: Author

As this policy has been disaggregated, so any firm's cash flows and performance can in principle be divided between intermediation and warehousing. What is important is not the quantum of the numbers, but rather that the cash flow profile and profitability of these two activities can be quite different from the whole which they make up.

It seems clear that the intermediation function is essential to the firm's activity. The warehousing function, however, represents a decision. Since the decision will dramatically alter the firm's financial outcomes, it should be considered a separate but critical management duty.

In summary, there are two sets of management issues which are quite distinct:

- First, the necessary function of intermediation. This involves deciding which customers to target, what products, features and terms to offer, and how best to serve them.
- Second, the optional warehousing function. This involves deciding what risks to retain in the firm's warehouse, what risks to hedge and how best to hedge them.

### **Risk Exposures and Hedging Mechanisms**

Insurance firms use a variety of mechanisms to hedge their different risk exposures. To start with, every insurance firm designs its intermediation efforts to select and influence the profile of the risks it will ultimately have available to warehouse. It will target risks through tactics including setting tough new customer criteria, pricing carefully relative to competitors (sometimes to be deliberately uncompetitive) and investing in distribution channels likely to reach its most desirable customer segment.

Relating this back to expense allocation, intermediation activities such as these will reduce the costs of hedging risks either externally or internally. In the calculations above, their value add (reduced hedging costs less intermediation expenses) will be captured properly under intermediation.

Once risks are intermediated, there is a further range of new mechanisms that can be employed to hedge and thereby manage the risks retained in the warehouse of the firm. In this context, "retention" should not be misinterpreted. Unlike banks with mortgage loans, which are assets that can be disposed of, insurance policies represent liabilities that cannot be sold at the discretion of the insurer. Therefore hedged insurance risks remain on the insurer's balance sheet but are offset by a corresponding hedging instrument.

Turning to the risks and mechanisms themselves, one can define two categories: underwriting risks and economic risks.

### Underwriting Risks

These are risks that are specific to a customer and relate to some contingency or event. They correspond to what many would consider to be traditional insurance risks. Examples would be:

- Mortality or disability risk under a life insurance contract;
- The risk of an individual driver incurring a damage claim under an auto policy;
- The risk of a household claiming for flood damage under a home policy;
- The risk of a shipping company claiming for a vessel lost at sea under a marine policy.

While the nature of these risks is inevitably individual to the insured customer to some degree, there are underlying contingencies or events which impact entire groups of customers. For example, the risk of a hurricane in Massachusetts will impact on the likelihood of household claims for all insured customers in Cambridge. Ultimately though, the resultant claim will also depend on individual factors such as the structural soundness and design of the insured home.

Insurers will hedge their underwriting risks most commonly through reinsurance. In return for a reinsurance premium, the reinsurer will share in the responsibility for all or some of the claims. The reinsurance contract may relate to a group of policies and share those claims regardless of the cause, or may be triggered by an event which results in many claims simultaneously, such as hurricane catastrophe reinsurance. Reinsurers themselves may in turn share their own exposures with one another in a reinsurance mechanism called retrocession.

While a reinsurance arrangement is the dominant hedging mechanism for underwriting risks, there has been a trend in recent years for some insurers to also make use of securitization methods. The best known example is the Catastrophe Risk Bond. This is a debt instrument where the investor forfeits the principal on the occurrence of a defined catastrophic event.

### Economic Risks

These are risks that relate to macro factors like inflation, interest rates, equity markets, credit default and currencies. These risks normally arise from two sources:

- The benefits of the insurance contract itself may offer guarantees to the customer that relate to these risks. For example, in an annuity contract the regular payments may be guaranteed to keep pace with future inflation.
- More generally, any insurance contract inevitably results in a timing mismatch between cash inflows and cash outflows. So premiums may be payable for a number of years until an insured event takes place, at which point a lump sum may be payable.

Clearly, the insurance firm has to invest cash inflows so that it can afford the outflows when they fall due in the future. The firm's investment strategy is therefore pivotal in determining the economic risks to which are warehoused by the firm. The firm can compound economic risk by investing in instruments where the income profile is quite different from its liability cash flow profile in term and nature, or it can seek to hedge risk by matching these profiles. The derivative markets have created opportunity for a tailoring of exposures to meet very specific firm requirements. Of course, even a precisely matched investment strategy will hold credit risk which will then be determined by the credit quality of the counter-parties.

To get a sense of the impact on the firm of its hedging decisions, we return to the example of the simple insurance policy with a 5 year term. We assume that the intermediation of the policy has taken place. Therefore premiums and other policy terms have been agreed contractually. Looking forward we consider the impact on the firm of four scenarios where actual experience will differ from the expected base scenario. In the base scenario the interest rate is 10% and expected claim is \$3000 as before. The four scenarios each consider a change in one of the variables, either up or down. The scenarios are shown in Table 1D.

**Table 1D: : Insurance Cash Flow Example - Sensitivities of Present Values to Assumption**

**Changes**

<b>Scenarios</b>	<b>PV: Total Firm</b>	<b><u>PV</u> Warehousing</b>	<b><u>PV</u> Intermediation</b>
Base Scenario	280.66	55.37	225.29
Discount Rate increase to 12%	368.26	154.90	213.36
Discount Rate decrease to 8%	179.92	-58.17	238.09
Expected claim increase to USD 4000	-340.26	-565.55	225.29
Expected claim decrease to USD 2000	901.58	676.30	225.29

Source: Author

From the table of results it is clear that the value of the total firm varies considerably depending on changes in these two variables. It is also striking that, in this example, almost all of that variability is due to its warehousing activities and very little to intermediation. If the firm had indeed hedged its risks it would have completely altered its own profile as an investment. It underlies again the importance of the warehousing decisions in determining the firm's financial outcomes.

**Focusing on Risk Warehousing and Hedging**

The remainder of this paper will focus on the firm's warehousing activities and the question of whether and how to hedge different risks once they have been intermediated. The retention of warehousing risks is particularly interesting because of its impact on the firm's financial outcomes and the fact that it is mostly optional given the availability of hedging mechanisms.

Of course, the intermediation activities of the firm have risks too – in our example the change in interest rates does have an impact on the value of intermediation. There also may exist ways of hedging at least some of those risks. However, many of the most important intermediation risks will be operational or strategic in nature for which few external hedging mechanisms exist. Rather they would be best mitigated by management monitoring and specific action.

While we will focus on warehousing activities we should not ignore the key relationships and interdependencies between intermediation and warehousing in practice. For example, firms will often direct their intermediation efforts to those risks which they can warehouse most cost effectively, which means diversifying into risks that have low correlations with their existing exposures. This is one of the drivers of industry consolidation. Furthermore, the firm's hedging policy may influence its incentives and behaviour in intermediating particular risks. So a firm that is fully hedged on mortality risk, for example, may take less care in its life underwriting activities on new customers than otherwise. This will be of key concern to its hedging counter-party (the reinsurer) who in practice may require the firm to retain some residual risk.

In the next chapter we review the theory of corporate finance and its application to insurance firms, building a framework within which the hedging decisions for warehousing risks can be considered.

## **Chapter 2**

### **Hedging Theory for Insurance Firms**

Financial firms are different from non-financial firms because their customers are also providers of capital (Smith and Exley, 2006). These relationships are increasingly complex. There are many different counter-parties who have a claim, contingent or otherwise, on the assets of the firm. When it comes to hedging and risk management, the key question is how to maximise value for the residual claimants of the firm, the shareholders, while taking account of risk.

We begin by considering some of the basic theories of corporate finance that have wide acceptance and apply to firms in general: Modigliani Miller Irrelevance Theorem, Trade-off Theory and Pecking Order Theory. Together, these theories introduce the critical concept of frictional costs. We then turn to insurance firms more particularly, where frictional costs are essential to determining the optimal hedging approach.

#### **Modigliani Miller Irrelevance Theorem**

Modigliani and Miller (1958) famously established in their landmark paper that the capital structure of a firm, that is its financing decisions, are irrelevant in determining the value of the firm, under the assumption of perfect capital markets. This is known as the MM1 proposition or MM Irrelevance Theorem.

The essence of the argument is that assets capture the future cash flows of the firm whereas financing decisions merely allocate the risks and benefits of those cash flows between the different claimants. If there is a change in capital structure, one claimant's gain will be another's loss. These gains and losses will be reflected in the cost of capital required by different claimants so that total cost of capital will remain unchanged. MM1 assumes perfectly functioning markets.



## **Trade-off Theory**

While MM1 claims that capital structure does not matter, trade-off theory proposes that there is in fact an optimal capital structure. It does so by focusing on two areas of market imperfection assumed away by MM1: interest tax shields and costs of financial distress.

Interest tax shields arise because of the deductibility of interest versus dividends. The idea is that firms should substitute debt for equity because of the tax savings secured by the additional interest payments. Trade-off theory observes that increasing debt on this basis only adds value up to a point because the more debt increases the higher the likelihood of financial distress (going bankrupt or approaching it) and the costs that go with it. The theory suggests there is an optimal point where the tax benefit of additional debt is equal to the expected cost of financial distress from the additional debt (Brealey et al, 2010).

Some of these costs of financial distress are directly related to the process itself, like lawyer's fees. Others arise because of the presence of agency problems, where managers have incentives which differ from those of the shareholders. For example, managers of firms in distress may have an incentive to take greater risks because of the asymmetry of their own remuneration. If the firm goes bankrupt they get nothing but if the firm gains then their remuneration increases accordingly. From the perspective of the shareholder these are agency costs which destroy value (Brealey et al, 2010).

These agency costs, explored in Jensen and Meckling (1976), have been the basis of a great deal of corporate finance deal-making. Jensen (1986) analysed the stock price gains on announcements of leveraged buyouts. According to the MM Irrelevance Theorem there should be no value added by the mere substitution of debt for equity. Jensen however demonstrated that the leverage added value by forcing management, through the pressure of having to meet contractual debt service payments, to cease over-investment in negative net present value projects. This over-investment is an agency cost that was eliminated to enhance the value of the firms concerned. The managers of those firms were incentivised to grow the firm by continued investment even if that future growth did not meet shareholder's required return thresholds.

## Pecking Order Theory

Pecking order theory recognises that there is a further violation of MM1's assumptions that is ever-present in financial markets: asymmetry of information. This occurs because the managers of the firm have more accurate information about the firm's prospects than external providers of capital. Its existence means that the mere action of a firm issuing equity signals that its prospects are poor, otherwise it would have issued debt and reserved upside for existing shareholders (Myers and Majluf, 1984). The result is that firms raise capital in a *pecking order*, exhausting sources in the order of the least impact of this information asymmetry. They start with internal retained earnings, then debt and finally equity (Brealey et al, 2010).

## Financial Firms: Acute Frictional Costs

The capital market imperfections discussed above introduce us to the key concept of frictional costs. Frictional costs refer to the phenomenon that a firm is valued in the capital market at a discount to its net present value<sup>1</sup>. It happens because shareholders do not have full confidence that management will allocate capital optimally between the current and future projects available to the firm. These frictional costs are the result of agency problems, asymmetries of information and opacity<sup>2</sup>.

Merton and Perold (1999) assert that financial firms generally experience high "information and agency costs in raising equity capital". They argue that this is because of the particular opacity of the firm's asset and liability positions as well as the speed with which those positions can be changed by management, undetected by shareholders except with a significant reporting lag.

Thinking of an insurance firm, it does seem intuitive that the frictional costs of raising equity capital are likely to be high since insurance contracts are often highly opaque to outsiders and require complex actuarial modelling to achieve valuations and test sensitivities. It is unlikely that an outsider

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<sup>1</sup> More accurately, the discount is to the optimal, value-maximising portfolio of current and future projects that the firm has available to it.

<sup>2</sup> Opacity refers to the complexity of a firm's operations and the difficulties experienced by an outsider in assessing the firm's business and its prospects accurately.

will have a good grasp of these details. Furthermore, on both the asset and liability sides of the balance sheet the firm will normally have positions that can change quickly at low cost.<sup>3</sup>

These high frictional costs are evidenced by the fact that financial firms devote significant resources to the subjects of hedging and risk management. After all, if there were no frictional costs, that is in the world where MM1 applies, shareholders in financial firms would hedge their exposures themselves and retain only the risks that suit their profiles. In that scenario hedging or risk management by the firm itself would merely incur unnecessary costs (Froot and Stein, 1998).

The very existence of institutional financial firms (whether banks or insurance firms) is precisely because some of the risks that they intermediate are information sensitive<sup>4</sup>, that is characterised by high friction, otherwise the economic function would be performed by the capital markets (Froot and Stein, 1998).

Merton (1995) characterises this relationship between markets and institutional intermediaries as a dynamic competition. Financial products which are low volume, non-standard, not well understood and with information asymmetries are most efficiently handled by institutions. Products can evolve in both directions in this regard over time (Merton, 1995).

### **Hedging Theory: Economic Risks**

So if financial firms have high frictional costs of raising capital, how should the question of risk warehousing and hedging be approached?

Froot and Stein (1998) demonstrate that if a financial firm is to be value-maximising for shareholders it will always fully hedge its liquid risk exposures and carry no net risk on its balance sheet. The essence of the argument is that these liquid risks can be hedged in a market where the spread costs of the hedging instrument will be very low. The alternative to hedging is to support these risks with the

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<sup>3</sup> Jaffee and Russell (1997) discuss further reasons why insurers find it costly to raise and retain capital, including tax, accounting and regulatory aspects.

<sup>4</sup> Froot and Stein (1998) explain that this means that in order to price and intermediate the risk you need to have access to specific information about the risk, which makes it impossible to trade the risk in a standardised security on a liquid market.

firm's own capital, which we have determined carries a high degree of frictional costs. The value-maximising strategy is therefore to hedge these risks rather than warehouse them.

The economic risks of insurance firms that we categorised earlier (including interest rates, currencies and equity markets) clearly fall into the Froot and Stein (1998) description of liquid risks. For each of these risks there exist sophisticated and highly liquid markets of derivative instruments for hedging purposes. The implication is therefore that insurance firms should aim to fully hedge these economic risks and warehouse no net risk for the firm's account.

### **Hedging Theory: Underwriting Risks**

Regarding other less liquid risks, Froot and Stein (1998) conclude that it is unclear whether hedging will add value relative to warehousing. They pose the hedging decision as a trade-off. The amount of risk to be warehoused should be determined so as to maximise the firm's risk-adjusted returns. This involves weighing up the spread costs on the hedging instrument in question against the costs of supporting the risk with the firm's own capital.

Let us recall the underwriting risks of insurance firms which we described earlier. They included life contingencies like mortality and sickness rates as well as property casualty perils like earthquakes and auto theft rates. These risks are hedged through reinsurance markets and recently also through securitization structures. Very little of this risk is traded in liquid, public markets through standardised instruments. It is therefore fair to assume that these underwriting risks fall into Froot and Stein's (1998) illiquid variety.

We will look specifically at the hedging of the underwriting risk in terms of the reinsurance decision and the key trade-off involved, which is the cost of risk warehousing versus the cost of reinsurance.

The reinsurance transaction is the transfer of risk from one institution to another. One should consider both the costs incurred in the transfer, as well as the relative costs for both the insurer and the reinsurer of bearing the risk.

The reinsurance trade-off can therefore be described as:

**Insurer's Risk-Bearing Costs (A)**

versus

**Reinsurer's Risk-Bearing Costs (B) plus Risk Transfer Costs (C)**

Reinsurance will add value if  $A > B + C$ <sup>5</sup>

The Risk Transfer Cost (C) consists of two main elements<sup>6</sup>:

- The margin imposed on the expected claim (above the insurer's estimate) by the reinsurer to take account of asymmetry of information and opacity. Since the decision to reinsure is at the option of the insurer, the reinsurer faces adverse selection effects in the same way as the insurer does with its customers.
- The cost of the reinsurer's intermediation costs. Many of these costs are related to underwriting activities which try to correct asymmetries of information. This then reduces the margin imposed on the expected cost of the claim (the point above).

One of the reinsurer's main competitive strategies would be to conduct underwriting at the level which optimises (minimises) the above Risk Transfer Costs.

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<sup>5</sup> This assumes that the reinsurance premium will only include B and C as margins above the expected cost of the claim.

<sup>6</sup> Cowley and Cummins (2005) also mention a further cost, the potential competitive loss from making private customer information known outside the firm.

Once the risk has been transferred, the institution bearing the risk then faces Risk-Bearing Costs (A,B). Froot and Stein (1998) analyse these costs of carrying risk in detail and point to the following key elements<sup>7</sup>:

- The frictional costs of holding capital to support the risk. For insurance firms these can be assumed to be relatively high and are related to agency, opacity and informational problems as we have discussed.
- The increase in the volatility of the firm's total profits from the addition of the new risk. This is different from the individual risk's volatility. It takes account of the benefits of risk diversification resulting from imperfect correlations between the individual risk and the firm's existing portfolio. The lower the covariance between a risk and the rest of the portfolio, the higher the diversification benefit.

Froot (2007) takes this framework a step further by applying it to insurance firms in particular. In addition to the above factors he highlights two further considerations:

- First, insurance customers are highly risk averse and so risk in the insurer's overall portfolio has the effect of reducing premiums and ultimately returns on the insurer's total underwriting business.
- Second, due to the non-linearity in the frictional costs of raising capital (the cost increases with the amount raised) the negative skewness of a risk's profile has a particular cost impact.

In line with this, Cummins and Trainar (2009) describe the risk-bearing cost as a "risk charge... assumed to reflect market systematic risk, the co-variability of risks with the insurer's existing portfolio, and the contribution of risks to the negative asymmetry of the insurer's profit distribution".

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<sup>7</sup> Froot and Stein (1998) also explain the trade-off in costs between raising capital now versus later when needed. There is an optimal amount of raised capital which minimizes these expected costs, an equilibrium point where frictional costs from these two approaches are equal.

Restating our reinsurance trade-off equation, reinsurance would make sense if:

$$A - B > C$$

In words, the reinsurer needs to offer the insurer a reduction in Risk-Bearing Costs (A-B) sufficient to more than offset the Risk Transfer Costs. From the above discussion this reduction can have a number of possible sources:

- Differences in capacity to bear volatility (through lower correlations and better diversification) and negative skewness;
- Differences in frictional costs of capital due to lower opacity, agency costs or information asymmetries;
- Differences in impact of increased risk on perceptions of customers and therefore product margins.

These differences are no doubt dynamic. One can imagine that they could vary over time and also according to the structure of the reinsurance transaction. For example, gains from the reinsurer's superior capacity to bear volatility is likely to be highest for the initial ceded amounts. This is where there would be the biggest reduction in portfolio risk for the insurer and the smallest gain for the reinsurer.<sup>8</sup> On the other hand, Risk Transfer Costs may increase with higher ceded amounts because of greater concerns about adverse selection.

For example one might think of two global diversified insurers contemplating ceding risks to one another. If there are no relative advantages in Risk-Bearing Costs, each firm is likely to retain its own risks due to the barrier of Risk Transfer Costs.

On the other hand, if a small, niche insurer is reinsuring with a global, diversified reinsurer, one could expect there would be significant advantages to the reinsurer in Risk-Bearing Costs, at the very least

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<sup>8</sup> The intuition is that whatever the correlation between the individual risk and the portfolio, the correlation of the incremental share of that risk ceded will increase with the amount of the risk already in the portfolio.

from having a more diversified portfolio of risks. In that case the optimal solution could be a very high level of reinsurance.

### **Conclusion**

The discussion so far provides us with some guiding principles for how we would expect value-maximising firms to behave with regards to hedging. Any economic risks, which can be hedged at low spread costs, would be hedged, leaving the insurance firm's risk warehouse immune to the risk in question. Regarding underwriting risks, the optimal retention levels would be determined by comparing improvements in Risk-Bearing Costs offered by the reinsurer to the Risk Transfer Costs inherent in the transaction.

In the next chapter the data on firm behaviour will be compared to theoretical expectations.



## **Chapter 3**

### **Comparison to Practice**

We will look first of all at the evidence on the hedging of economic risks.

#### **Insurer Stock Returns and Interest Rate Risk**

Carson et al (2008) conducted a study of stock returns of portfolios of insurance firms based on data from 1991 to 2001. The study focused inter alia on the sensitivity of stock returns to market risk and interest rate risk.

The conclusion of the analysis is that the stock returns of insurance firms do have a statistically significant sensitivity to both the equity market and interest rates. Life insurance firms were found to have a higher degree of sensitivity to interest rates than both property/casualty (PC) and health insurers. It suggests that insurance firms retain a degree of interest rate risk on their balance sheets and that the market accounts for this in the pricing of these securities. The sensitivity is negative, meaning that an increase in interest rates typically reduces the value of the insurance firm.

This study further confirms the conclusions of Brewer et al (2007) that life insurer stock returns do exhibit sensitivity to interest rates. Staking and Babbel (1995) had earlier shown that such observed interest rate exposures destroy shareholder value in the property liability insurance industry<sup>9</sup>.

#### **Insurer Net Assets and Interest Rate Risk**

Every listed insurance firm publishes in its Securities and Exchange Commission (SEC) 10-K filing an assessment of its vulnerability to particular economic factors. In most cases it includes interest rate risk, equity market and currency risk, although we will focus on interest rates.

While the earlier studies quoted looked at the behaviour of stock returns, the 10-K figures show the impact on the published net assets of the company from a change in the level of interest rates, that is

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<sup>9</sup> The authors do note some limited empirical evidence of value being created at very high interest rate levels.

an upward level shift in the yield curve. All other assumptions underlying the financial statements remain unchanged.

Exhibit 1 shows the above data from 2005 to 2009 for six of the largest insurance firms in the US.

Exhibit 2 explains the rationale for the selection of the firms as well as some important qualifications relating to the data.

Exhibit 1A shows the net assets of the firms over time. It is clear that the net assets of the firms declined significantly in 2008, no doubt as a result of the market collapses during the financial crisis. These rebounded in 2009.

Exhibit 1B shows the impact of the modelled interest rate increases on the net assets (\$ millions) of the firms, as reported for each year. In most cases the modelled increase was 100 basis points (see Exhibit 2 for details). It is quite striking how the impacts for almost all the firms have remained relatively stable over the period.

AIG is the exception to this because it had a significant change in methodology. From 2005 to 2007 this was based on the Value-at-Risk (VAR) approach, estimating the maximum possible loss with 95% confidence over a 1 month time horizon. In 2008 the company changed to an approach modelling a 100 basis point upward shift in the yield curve, resulting in a sharp increase in its reported exposure. Clearly AIG's previous reporting methodology considerably under-estimated the risks which were being warehoused on its balance sheet compared to its peers in the insurance industry.

The stable trend in impacts in Exhibit 1B is therefore best seen in the average excluding AIG.

Exhibit 1C shows the sensitivity of the net assets to the modelled interest rate increases (impact divided by net assets as a percentage). Again when looking at the average it is best to exclude AIG because of the methodology change.

There are some important conclusions here:

- Given our expectation of firms hedging away their interest rate risks, the sensitivities are perhaps *surprisingly large*.
- The sensitivities vary widely across firms. This variation could be the result of differences in risk strategies, liability profiles and estimation techniques. Berkshire Hathaway has the lowest sensitivity which may be unsurprising given its high proportion of non-insurance activities.
- When net assets fell in 2008, the modelled impacts did not change significantly, resulting in a significant *increase in sensitivity* at the time when public risk aversion may have been at its highest.

Overall, the data supports the conclusions from the empirical studies of stock returns that interest rate risk remains significant for insurance firms and has hardly been hedged away, despite the growth in the depth and variety of derivative instruments available in the public markets over the last number of years. Clearly firms may not be behaving in a manner fully consistent with our theoretical framework.

### **Underwriting Risks**

To assess the warehousing of underwriting risks, one can look at how much insurers are reinsuring of the risks which they intermediated. Table 3A shows the amount of reinsurance ceded (that is bought) as a percentage of gross written premiums by the 370 US Life/Health Insurers included in A.M. Best's Aggregates and Averages report for 2010.

**Table 3A: Reinsurance Ceded by US Life/Health Insurers**

Year	Reinsurance %
2005	15.4
2006	14.2
2007	16.0
2008	16.7
2009	26.4

Source: A.M. Best's Aggregates and Averages (2010)

For underwriting risks, it seems clear that firms continue to bundle the intermediation and warehousing functions together for a great deal of the business they conduct.

In terms of our framework, it indicates that Risk Transfer Costs prove prohibitive in many cases, or improvements in Risk-Bearing Costs from reinsurance are insufficient incentive.

Given the obvious scope for more reinsurance in general, we might conclude that efforts to reduce Risk Transfer Costs, by addressing informational problems through better data management and more open collaboration, could reap significant benefits for all parties. In this regard an important perspective is provided by Jaffee and Russell (1997) who found that longer term relationships between insurers and reinsurers improve information-sharing.

Likewise perhaps there may be opportunities for reductions in Risk-Bearing Costs through industry consolidation.

Finally, the sharp increase in the reinsurance percentage in 2009 is worth further exploration. Coming after the crisis of 2008 it may suggest a reduction in risk based on higher risk aversion. Behavioural issues like this will be discussed below.

## **An Observed Bias Towards Risk**

The above analysis indicates that insurance firms may be taking more risks than would be expected, whether economic or underwriting. It suggests that there may be other factors outside of our theoretical framework that impact on hedging decisions. The section below explores some of the possible drivers of this observed bias towards taking risk.

### *Confidence in Beating the Market*

Froot (2007) speculates that one of the primary reasons for the retention of economic risks may be a confidence in achieving returns in excess of the market through investment skill, although noting that such abilities are not borne out in performance, with the exception of Berkshire Hathaway. Malmendier and Tate (2009) conducted a study on the effect of CEO acclaim (and induced confidence) on the performance of firms, concluding that the results are mostly negative.

### *Management Incentives and agency problems*

The asymmetrical nature of management remuneration incentivises risk-taking. Where management incentives are geared towards absolute growth ignoring returns on capital risk-taking behaviour will be even more encouraged. Even where the metric is return on capital, adjusting for risk in profit outcomes is difficult and may have a significant lag.

As Jensen and Meckling (1976) famously set out, managers have a tendency to over-invest rather than resist negative NPV projects and pay out capital to shareholders. The same principle applies to risk warehousing.

### *Regulatory Capital Requirements*

Insurance firms are highly regulated in every jurisdiction. This arises from the public interest of ensuring that policyholders, who have problems of asymmetry and complexity of information, have their claims paid when due. One of the central tenets of such regulation is the requirement that insurance firms hold specified minimum amounts of capital to back their liabilities. Should the firm's

capital levels fall below the minimum there will be an intervention from the regulatory authorities involving additional reporting, management action or, in the extreme, seizure of control.

To the extent that regulatory capital requirements do not fully appraise risks accurately on a basis consistent with market valuations, insurers may find themselves required to hold capital in excess of the economic capital they would ordinarily allocate to their risks. This is compounded by the margin which most insurers hold above the minimum regulatory requirement because of the costs (including management time and reputation) of falling below it. The rational management response to a position of forced excess capital is to take on commensurately more risk.

#### *Information Problems with Customer and Rating Agency Assessments*

The sensitivity of insurance customers to the credit-worthiness of the insurer has been discussed earlier. Similar to regulatory requirements, to the extent that these perceptions demand the holding of absolute amounts of capital and do not accurately reflect the risks on the balance sheet it may actually incentivise risk-taking behaviour by the rational manager.

The assessments of rating agencies have a similar dynamic. In practice the relationships with all three stakeholders (regulators, customers, rating agencies) are inter-dependent. The assessments by regulators and rating agencies will no doubt effect how customers view the firm.

#### *Mutuality*

The theory of capital and risk we have developed is based on the proprietary form of the insurance firm. Mutual insurance firms, which remain an important sector of the insurance industry in the US, are concerned not with returns to shareholders but rather provision of benefits to policyholders. While shareholders are concerned about risk-adjusted returns and impose frictional costs when they provide capital to insurance firms, policyholders are presumably motivated by maximising their policy benefits. For the shareholder the trade-off is always against an alternative investment available in a liquid public market, policyholders are not able to trade their holdings in the insurance firm in a securities market of any kind. It follows from these differences that mutual insurance firms are likely

to face different pressures regarding frictional costs, capital management and risk warehousing than proprietary firms. Wells and Cox (1995) show that mutual insurance firms hold more free cash than proprietary firms.

#### *Barriers to corporate action*

Jensen (1986) showed how leveraged buyouts can add value by reducing management over-investment. Thus corporate action, including mergers, acquisitions and buyouts, have been a vehicle for reducing agency costs. The insurance sector has a number of barriers to such action.

Firstly, the regulator often needs to give explicit approval. This is compounded in the US by the fact that insurance business is primarily regulated state by state.

Secondly, debt structures and levels themselves are carefully regulated for insurance firms to protect the interests of policyholders against risky capital structures that might jeopardise the firm's claims-paying ability.

#### *Basis Risk*

Finally, if insurers wish to hedge their exposure to economic risks completely, they would need to ensure that the underlying basis of their hedging instruments exactly matches the basis of their asset and liability portfolio with respect to the risk in question. For example, liabilities with durations of 30 years (like a life insurance policy) need to be hedged with an asset with an identical duration, among other factors. To the extent that liquid instruments with the required characteristics are not available any hedging strategy will be imperfect.

## Chapter 4

### The Case for Insurance-Linked Securitization

We will now turn to the potential role of insurance-linked securitization as a mechanism for capturing capital efficiencies in insurance firms. We will frame the argument for insurance-linked securitization in terms of its impact on four aspects of the theoretical frameworks that have been developed: Frictional Costs, Risk-Bearing Costs, Risk Transfer Costs and Risk Bias. Before progressing to these arguments, we will conduct a conceptual overview of securitization in general and insurance-linked securitization in particular.

#### The Concept of Securitization: Definition and Overview

According to Gorvett (1999) some of the earliest academic references to securitization were in fact in the context of insurance. However, the concept has become most closely associated with the mortgage market, where vast volumes of mortgage-related securitizations took place in the decade leading up to the financial crisis of 2008/2009.

Since the crisis securitization has become associated with financial risk and even unregulated excess. However, as a concept securitization continues to hold considerable appeal as a mechanism to unlock capital efficiencies and transfer risk efficiently throughout markets and economies.

In defining securitization one could access a variety of sources, amongst both academics and practitioners. These definitions have not been constant over time but have changed with financial innovation.

Fabozzi and Kothari (2008) draw on a definition used by the Bank for International Settlements (2005), defining securitization as “*structured finance instruments (which) can be defined through three main characteristics:*

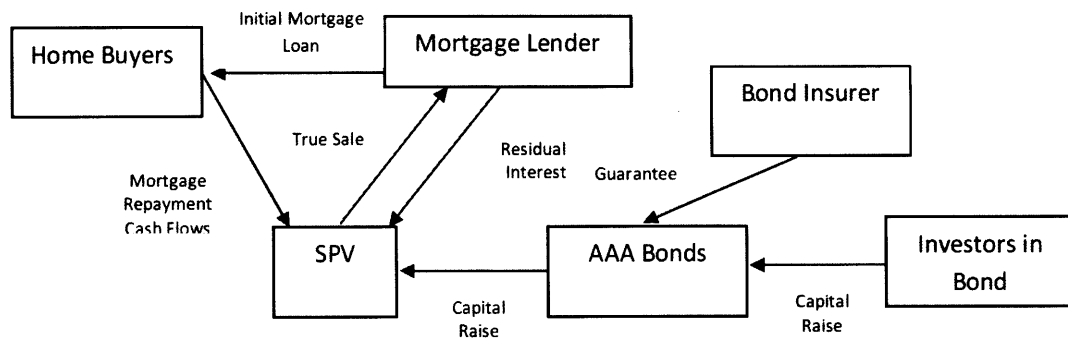
- *Pooling of assets (either cash-based or synthetically created);*
- *Tranching of liabilities that are backed by the asset pool;*



- *De-linking of the credit risk of the collateral asset pool from the credit risk of the originator, usually through the use of a finite-lived, standalone special purpose vehicle (SPV).“*

To illustrate these principles let us consider an example. A mortgage lender originates a portfolio of mortgage loans from home –buyers. The mortgage lender then sells the future cash flows, consisting of the repayments of interest and capital, to an SPV. The SPV in turn finances the purchase with the issuance of a bond to the capital markets. The bond is in turn insured by a third party and is rated AAA as a result. Figure 4A illustrates this example graphically.

**Figure 4A: Example of Mortgage Securitization Structure**



Source: Author

In essence, the future cash flows of the mortgages have been used as collateral to raise debt from the capital markets. However, one of the key aspects of securitization as distinct from more general secured lending is that the capital raised, in this case via bonds issued by the SPV, can have a higher credit rating than the originating institution (Fabozzi and Kothari, 2008).

This may be achieved by a number of features:

- True Sale: There has been a true sale of the mortgage repayment cash flows from the mortgage lender to the SPV. They no longer belong to the mortgage lender legally.
- Bankruptcy remoteness of SPV: The creditors of the mortgage lender therefore have no direct claims on the SPV or its asset, the mortgage repayment cash flows.
- Over-collateralisation: It is likely that the amount of the debt raised is lower than the fair value of the mortgage repayment cash flows, to ensure a margin of safety for investors.
- Tranching: The residual interest of the mortgage lender in this case illustrates that the remainder of the risk after repayment of the debt falls on the residual claimant. Many structures would include multiple layers of debt in tranches below the safest AAA tranche. By creating tranches in this way the high credit rating on the safest debt can be preserved.
- Credit Enhancement: The bonds have been insured by a third party who would make good any shortfall for investors in the event of default by the SPV, subject to its own solvency (it would itself be rated AAA in this case).

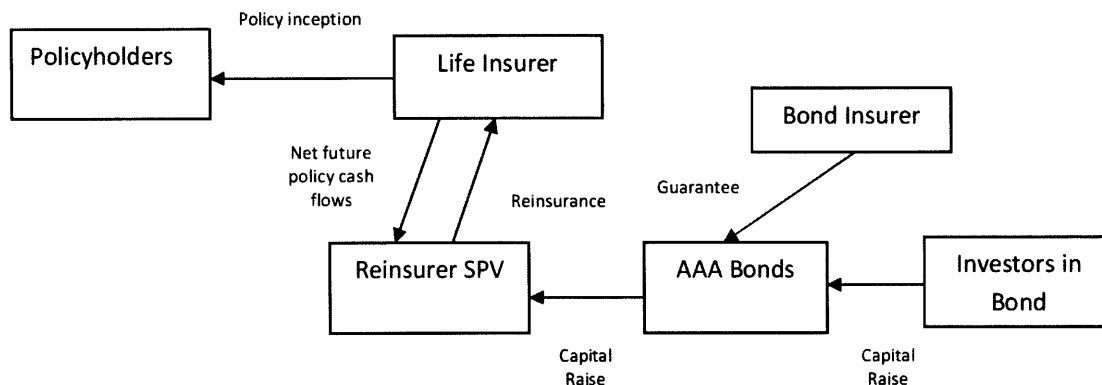
### **Insurance-Linked Securitization**

Gorvett (1999) defines insurance-linked securitization as a transaction involving the transformation of underwriting cash flows into capital market securities. While these transactions may take a number of forms, their essence is very similar to the simple mortgage example above. The insurer will cede a defined set of future cash flows, whether assets or liabilities, to a vehicle which in turn will engage the capital markets for funding.

We will consider two examples here to illustrate the securitization of both insurance assets and liabilities.

Life Embedded Value Securitization: Being conceptually a securitization of net assets, this is quite easily comparable to the mortgage securitization. Figure 4B sets out the structure in similar terms.

**Figure 4B: Example of Life Embedded Value Securitization Structure**



Source: Author

A comparison between the two diagrams shows that the primary difference is that the embedded value securitization does not involve a true sale to the SPV. This is because legally it is very difficult or impossible for a policyholder contract to be unilaterally sold or transferred to a different entity. The transfer of cash flow is therefore via a reinsurance agreement. The result is that the bankruptcy remoteness of the SPV is difficult to achieve. Consequently it is more difficult or costly to achieve a AAA rating.

**Catastrophe Risk (CAT) Bond:** The second example illustrates the securitization of a contingent liability. Cummins (2008) describes the CAT Bond as a “fully collateralized instrument that pays off on the occurrence of a defined catastrophic event”.

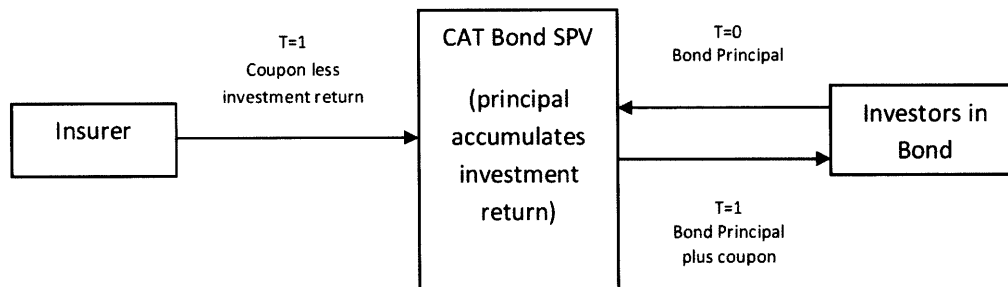
Insurers face losses in the event of large events which lead to an accumulation of multiple claims. For example, a large hurricane that hits the east coast of the US will result in property liability claims from many thousands or millions of policyholders. A CAT Bond provides reinsurance to the insurer’s risk.

For example, a one year bond with annual coupon is raised from the capital markets with the following characteristics: If a prescribed event occurs before its maturity, say a hurricane of at least a particular strength in a given geographical area, investors receive the coupon but forfeit the principal. If on the other hand no such event occurs investors receive the principal plus coupon at maturity. The coupon on the bond will reflect the appropriate risk-adjusted interest rate for such a debt instrument as well as a premium for the reinsurance provided.

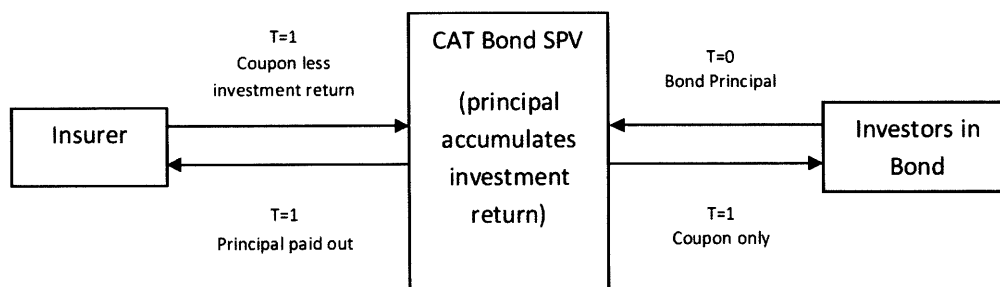
Figure 4C illustrates the structure under the two scenarios:

**Figure 4C: Example of Catastrophe Risk Bond Structure**

*Scenario: No event*



*Scenario: Catastrophic Event*



Source: Author

While the structure appears quite different to the asset-driven securitizations discussed before, in fact the underlying principles are identical. The insurer is packaging its future cash flows into securities to be purchased by capital market participants.

### **Corporate Finance Rationale**

Having defined securitization conceptually, what is its place in corporate finance theory?

Clearly, since MM1 views capital structuring as zero value-adding, it also sees no value in securitization which is merely an extension of secured lending.

However, Fabozzi and Kothari (2008) point out that securitization happens because it works in delivering value for issuers. He argues that the creation of different risk tranches caters to different investor preferences which in turn lowers costs of capital. Of course, MM1 would hold that the risks inherent in the assets are merely allocated differently and do not change in aggregate.

One can imagine that the Pecking Order Theory of Myers and Majluf (1984) has application. As managers find debt easier to raise because of signalling problems, it could be even more so for securitization where there are assets that can be set apart and collateralised to reassure investors.

We will try to frame some of the other explanations for the value add of securitization in terms of the four main concepts we have considered: Frictional Costs, Risk Costs, Informational Costs and Risk Bias. Where appropriate we will focus on insurance-linked securitization but many of the points will apply more generically as well.

#### Frictional Costs

We recall that leverage in general has benefits in forcing managers to return free cash to shareholders, reducing agency costs resulting from over-investment. This obviously extends to securitization as an instrument of leverage.

Schwartz (2002) argues that the specific value from securitization is an extension of the benefits of *secured* lending. By providing transparency on certain cash flows the frictional costs of capital are

lowered by a reduction in opacity. Isolating the cash flows for the benefit of a certain class of debt-holder gives clarity to financial distress scenarios and thereby reduces their expected costs.

This rationale extends naturally to insurance risk warehousing activities where cash flows are often highly complex, opaque and characterised by asymmetries. One might add that for highly regulated insurance firms where leverage is restricted, securitization may provide an acceptable mechanism to capture some of the value related to frictional costs that would otherwise be captured by conventional debt.

### Risk Bearing Costs

Insurance-linked securitization opens up the investment market for insurance cash flows from insurers and reinsurers to the broader capital market. This has three major benefits for Risk-Bearing Costs.

First, the capital markets dwarf the capacity of the reinsurance market for size. According to Cummins and Trainar (2009) even a large individual loss of \$100 billion represents no more than 0.5% of the capitalisations of the US equity and bond markets. This increase in depth should make it cheaper to insure extreme events. Froot and O'Connell (2008) describe limitations on reinsurer capital as one of the primary reasons for reinsurance prices at times appearing excessive to expected losses, particularly for extreme events. This builds on earlier work by Jaffee and Russell (1997) which demonstrates that certain extreme contingencies can be effectively "uninsurable" (for example, earthquake or hurricane risks) by the private insurance sector because of the difficulty reinsurers have holding large amounts of cash to back these risks over many years. Doing so becomes hard to justify to shareholders and can even make the firm a potential takeover target.

Secondly, insurance risks have very low or zero betas with other capital market factors (Cowley and Cummins, 2005). This means that the Risk-Bearing Costs for non-insurance firms to invest in an insurance securitization is lower than an insurance firm (all other things being equal).

Third, Cummins and Trainar (2009) argue that "loss co variability" (the degree of correlation between the risks within a reinsurer's portfolio) contribute to significant increases in reinsurance spread costs.

They therefore follow that securitization also offers existing reinsurance firms an opportunity for “pure play diversification”, the ability to invest in specific risk factors which best diversify their existing portfolio of risks.

### Risk Transfer Costs

Unlike the above factors which seem to be favourably impacted by securitization, Risk Transfer Costs represent a challenge. As we have seen, the non-insurance investors in these securitizations bring value precisely because they are new to the market and have risks that are uncorrelated. However, this remoteness from the insurance sector will likely be accompanied by increased Risk Transfer Costs.

To understand why, we can recall that Risk Transfer Costs consist of the margin above the expected claim imposed by the reinsurer plus intermediation costs. We also discussed that intermediation costs for reinsurers largely comprise underwriting expenses which are designed to reduce the margin on the expected claim. Therefore reinsurers will conduct underwriting in a manner that minimises the total Risk Transfer Costs.

The problem is that non-insurance investors do not have capacity for underwriting. They will therefore likely face sub-optimal Risk Transfer Costs in these transactions.

Another way to think about the issue is to consider the institutional power of the major reinsurers (Froot, 2008). Since informational issues play an important role in the pricing of reinsurance risks, reinsurers can gain a scale advantage in gathering and managing such information, particularly as it relates to the most information-sensitive risks (Cummins and Trainar, 2009). Further advantages accrue in the building of long term customer relationships and trust with the direct insurers (Jean-Baptiste and Santomero, 2000).

### Risk Bias

Finally, one might ask whether the issues relating to potential Risk Bias would be impacted by insurance-linked securitization.

One area is clearly basis risk. In Chapter 3 we mentioned that insurers may have difficulty finding hedging market instruments that have exactly the same basis or underlying characteristics as the economic risks embedded in their existing assets or liabilities. To the extent that securitization involves the pass-through of cash flows as they occur from the insurer to the investors, this seems to be resolved. However, the next question would be whether the investors themselves would underwrite those risks at lower frictional costs than the insurer's shareholders. The theoretical rationale for hedging all economic risks was that they were assumed to be liquid with very low hedging spread costs. To the extent that this assumption is violated one might question the hedging decision altogether.

A second promising area may be in customer credit sensitivity and rating agency assessments. We have discussed how the opacity of a firm's cash flows may distort the perceptions of these outside stakeholders. To the extent that securitization reduces opacity and divides the firm into discrete components more understandable to the outsider, one might see an improvement in the negative effects of these distortions.

## **Conclusion**

From this discussion it seems clear that there may be a trade-off at work when considering the costs and benefits of securitization for the insurance firm. While it brings potential improvements to Frictional Costs and Risk-Bearing Costs, it has the potential to increase Risk Transfer Costs.

In the final chapter, we will look at the development of the insurance-linked securitization market in more detail, comparing some of these conclusions against market practices and trends.



## **Chapter 5**

### **The Insurance-Linked Securitization Market: History and Prospects**

There is a wide range of insurance-linked securitization (ILS) instruments that have been developed and employed over time. We have discussed two examples illustrating the potential for assets and liability cash flows to be included: The Life Embedded Value Securitization and the CAT Bond.

The CAT Bond market is currently perhaps the most significant and liquid of ILS markets worldwide. We will look briefly at its history and consider some of the key factors in its development.

The life ILS market is still in its relatively early development stage. We will look at its current and recent status and consider how it may evolve going forward.

#### **CAT Bond Market**

Cummins (2008) provides a history and overview of the CAT Bond market. Following the devastating insurance losses caused by Hurricane Andrew in 1992 there were parallel efforts to explore utilizing capital markets to insure large catastrophic risk, in response to the reduced reinsurance market capacity and increased reinsurance spreads. Some of the initial efforts to launch publicly traded instruments, by the Chicago Board of trade and Bermuda Commodities Exchange, ultimately failed for lack of issuer and investor interest. This slow start is ascribed by Cummins and Weiss (2009) to opacity of underwriting information and asymmetries. Cummins (2008) also cites that insurers were concerned about disruptions to long-standing (and therefore information rich) reinsurer relationships. Given our discussion in Chapter 4, these obstacles are unsurprising.

Despite these early problems Hannover Re issued the first successful CAT Bond in 1994 for \$ 85 million. Since then the market for CAT Bonds has grown significantly, accelerating in the years 2005 to 2007. Exhibit 3 shows the issued number and volumes of CAT Bonds by year to 2007.

Cummins and Weiss (2009) attribute the growth from 2005 to the hurricane seasons of 2004/2005 and the reinsurance capacity shortage that resulted. This makes sense particularly when you consider the

argument of Cummins (2008) that CAT Bonds focus on the highest layers of reinsurance, where there is the lowest likelihood of claims and any capacity constraints in the reinsurance market are most acute. We have also already noted the work of Jaffee and Russell (1997) and Froot and O'Connell (2008) in exploring this dynamic.

Exhibit 4 shows the make-up of the investors in these CAT Bond issues over time. It is interesting that in the early years after 1997 it was still insurers and reinsurers that made up the majority of the investor demand. Less than half (45%) was from outside the insurance and reinsurance market, representing additional industry (Cummins, 2008). But by 2007 the share of investor demand consisting of insurers and reinsurers had dropped to 7% from 55% in 1997, indicating significant additional capacity.

The pattern seems to suggest that the initial participation of market insiders with lower Risk Transfer Costs was crucial in giving the market capacity and liquidity which then allowed outsiders to enter and take advantage of lower Risk-Bearing Costs.

The other interesting factor is standardisation. Cummins (2008) comments that while a number of different structures have been attempted over the years, the last few years have seen a concentration of security designs in some standard formats. This would contribute significantly to reducing informational problems (and therefore Risk Transfer Costs) for outside investors. Cummins and Weiss (2009) further emphasize the advancement in data technologies which have reduced the opacity of underwriting information.

The growing practice of Enterprise Risk Management may also have increased awareness of risks and the need for their mitigation (Cummins and Weiss, 2009). In our discussion the latter could be thought to have reduced some of the Risk Bias factors.

A look at CAT Bond yields is also instructive. After initially being considered expensive compared to traditional reinsurance, Cummins (2008) concludes that the spreads have fallen by as much as one third since 2001 and are now comparable to traditional reinsurance. For CAT Bonds to actually surpass reinsurance pricing may require the development of public markets. While these instruments

are traded on non-public secondary markets, the transactions to date have been by private placement (Cummins, 2008).

In conclusion, it seems that while industry capital shortage was a primary driver for issuers in the first CAT Bonds, the Risk Transfer Costs were such that it required the initial participation of existing insurance market insiders to establish a market which outsiders would find attractive to enter.

Furthermore, high initial yields were probably also essential to establish a market. Market insiders had little to gain from further diversification through CAT bonds rather than conventional reinsurance, therefore the yields needed to be attractive for them. Of course, ultimately it was the initial issuers who needed to accept the high yields, which they likely only did under the pressure of capital constraints.

### **Life Insurance-Linked Securitization**

Life ILS is a somewhat less developed field. A number of transactions have taken place, but the market is yet to achieve a depth or liquidity on the scale of the CAT Bond market. There are two broad categories of interest<sup>10</sup>.

#### **Securitization for Risk Financing**

The first example here is mortality risk bonds. These work very much like CAT Bonds except that the underlying risk is that of adverse mortality experience rather than catastrophe property casualty claims. The first known mortality risk bond was issued by Swiss Re in 2003 (Cowley and Cummins, 2005). The motivations for these structures would be very similar to CAT Bonds. However, one difference is that mortality has been generally thought to be improving and this may dampen the enthusiasm of potential issuers. Further, insurers seem to worry less about very extreme mortality experience than they do about catastrophic property casualty experience, which seems to manifest

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<sup>10</sup> This excludes life settlement or viatical transactions where policies are bought from policyholders and packaged for investors by outside parties. These structures are not motivated by insurer-driven capital or risk concerns but by arbitrage opportunities inherent in these product structures.

with some regularity. It may be that these obstacles prevent the mortality risk bond from becoming a widely used instrument in near term.

### Securitization for Capital Financing

The second area of interest is securitization for the purposes of raising capital. Here it is the cash flows from high volumes of more predictable policy contracts that are bundled into a package for investors. Cowley and Cummins (2005) provide an overview of the categories of transactions as well as some detailed examples of structures. The two types of structures that are of interest are embedded value securitizations and regulatory reserve financing<sup>11</sup>.

#### *Embedded Value Securitization:*

Here the insurer securitizes the future net cash flows from an identified batch of in-force policies. The example in Chapter 4 falls into this group.

The motivation may be to raise capital to fund the upfront expenses associated with new business flows or to fund acquisitions. It may also be to de-risk the balance sheet with regards to the block of business (Cowley and Cummins, 2005).

Some insurers undergoing a demutualisation process (converting from a mutual to a stock company) have used this to raise capital. A well-known example is Prudential Financial in 2001, the structure of which is covered in detail by Millette et al (2002).

Table 5A shows some of the most well-known transactions related to the embedded value securitizations.

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<sup>11</sup> A third category is mortgage securitization by insurance firms. This is not dealt with because it is not uniquely related to insurance.

**Table 5A: Examples of Embedded Value Securitizations**

<b>Firm</b>	<b>Year(s)</b>	<b>Amount</b>	<b>Purpose</b>
American Skandia (US)	1996-2000	\$862 million	To fund new business
Hannover Re (Europe)	1998-2000	€431 million	To fund new business
National Provident Institution (UK)	1998	£260 million	Resulting from Demutualization
Prudential Financial (US)	2001	\$1 750 million	Resulting from Demutualization
MONY (US)	2002	\$300 million	Resulting from Demutualization
Gracechurch Life (UK)	2003	£400 million	To fund non-insurance interests of holding company, Barclays
Norwich Union (UK)	2004	£200 million	To fund new business
Friends Provident (UK)	2004	£380 million	To fund new business
Forethought Life Insurance Co (US)	2004	\$135 million	To fund buyout

Source: Cowley and Cummins (2005), International Financial Law Review (2005), Reactions (2005), Reactions (2007)

### *Financing of Regulatory Reserves*

Some regulatory regimes create an opportunity for securitization to add value by raising capital or reducing capital requirements.

In the US, NAIC Model Regulation 830, otherwise known as Regulation XXX<sup>12</sup>, requires life insurance firms to hold onerous amounts of capital to back long term premium guarantees on certain types of term life business. Instead of holding the capital on their own balance sheets, some insurers have opted to comply by securitizing the business in question through special purpose reinsurance vehicles, employing jurisdictional arbitrage. In terms of the arbitrage reinsurers in jurisdictions unaffected by Regulation XXX are able to bear these risks with lower capital requirements.

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<sup>12</sup> This came into force on 1 January 2000 for most states and now applies in 40 of them (Rooney and Brennan, 2006)

Obviously the securitization only makes sense if the cost is comparable to or lower than a corresponding reinsurance agreement.

### **Growth Potential for Capital Financing**

The area of life insurance securitization for capital financing has particular promise because of its theoretical appeal. It involves securitizing high volume, low volatility cash flows rather than the extreme-event cash flows covered by the CAT Bonds. In terms of our framework, these cash flows ought to have lower opacity (and therefore Risk Transfer Costs) and as such should most easily be able to attract non-insurance investors. It is these cash flows that are in fact most analogous to mortgage or automobile loan securitizations.

In this way ILS has been quite different to its credit-related forerunners – its pioneering instrument (the CAT Bond) has highly unpredictable cash flows and is prone to extreme volatility (Gorvett, 1999). It makes sense only when in the context of capital shortages as we have discussed.

Overall, one might conclude that securitization for life capital financing will be poised for growth if there were a shortage of market capital to act as catalyst.

Pre the crisis of 2008, these sentiments were beginning to be strongly expressed in the industry. Schreiber and Silverman (2006) estimated that there would be rapid growth from 2007 onwards in life ILS. Ozizmir (2006) of Swiss Re concurred, reporting an expectation among some reinsurance players that 20-50% of life business would be securitized in the period from 2007-2012.

It was felt that the reasons for the slow development of the market historically were being addressed. Informational problems were being alleviated by technological advances in data management, reducing the time and costs involved in creating new and innovative structures.

## **State of the Market**

Goldman Sachs is one of the leading investment banks in the structuring of ILS. I interviewed Paschal Brooks, ILS Specialist in New York, on the state of this market and its outlook.

It is clear that the crisis of 2008 put an end to planned ILS transactions for at least 18 months until around the end of 2009. Since then the market has begun to pick up again, led by a resumption of CAT Bond issues. Life ILS, focused on capital raising, has also been revived with Goldman Sachs concluding around \$600 million of transactions in the last year.

Now that markets seem to have recovered from the crisis, the overall sense is that the rationale for life ILS is sound but the typical problems associated with establishing a new asset class are proving difficult to overcome.

### *Stand-off on pricing between Issuers and Potential Investors*

Most investors are asking for yields on structures of LIBOR plus 3-4 %, while insurers have access to much cheaper bank financing. According to Brooks, this stand-off on pricing results in many potential transactions going unexecuted.

From the issuer perspective, until there is a shortage of conventional capital sources many will be unwilling to pursue these more costly options. From an investor perspective, informational problems (Risk Transfer Costs) remain high for outsiders, while insiders require high yields to incentivise them to invest in securitized instruments rather than conventional reinsurance. The pattern mirrors the experience on the CAT Bonds.

According to Brooks, a brief look at the players in the potential investor base confirms this:

#### ➤ Insiders:

- Insurers in general do not invest in reinsurance assets and prefer direct business.
- Reinsurers require high yields to justify additional structuring expenses.

➤ Outsiders:

- Banks and Money Managers are often unwilling to commit resources to understanding a new asset class unless it offers immediate scale.
- Hedge funds, while always on the lookout for alternative asset classes, require significant yields to make it worth their while.

*Regulatory Frameworks Are Critical*

Regulation of insurance firms has been discussed as a critical element in capital management practices. This is all the more so for the growth of ILS given the potential requirement for capital constraints as a catalyst in the market's development.

Millette et al (2002) expressed the view that regulatory drivers in the US are key to the slow development of the market. In that context he was referring in part to the approach of US insurance regulators not recognising securitization of future premiums in the required statutory capital of the firm, which put an end to that growing type of transaction in the late 1980's. Cowley and Cummins (2005) reiterate that many of the life ILS transactions to date were related to regulatory requirements or opportunities, emphasising the need for regulations to incentivise efficient capital management.

*Solvency 2*

Solvency 2 refers to the process in the European Union of aligning all insurance firms in a common regulatory framework and capital regime. It has been in development for a number of years and is expected to deliver a set of firm guidelines by October 2011.

The key principles in Solvency 2 relate to market consistent valuation of assets, liabilities and capital buffers. It will expect firms to reflect the market spread costs of hedging instruments required to de-risk their balance sheets. This will have the effect of making the capital costs of warehousing risks explicit to management and is expected to lead to more careful consideration of hedging options and capital efficiency.



Solvency 2 may therefore create opportunities for life ILS as a more efficient option than risk warehousing. It may also increase capital requirements for certain firms which could force them to consider this form of capital raising or de-risking.

The key question is whether Solvency 2 will have a large enough impact to be a sufficient catalyst for the life ILS market. Brooks is doubtful. Contrary to initial industry fears, the latest round of stress testing (known as Quantitative Impact Study 5) has shown that most firms in the European Union will have enough capital under the new regime, as reflected in the latest proposals. In any event, any sanctions on under-capitalised firms will be phased in over a 5-10 year period.

In the US, which is not subject to Solvency 2 and where regulation is largely state by state, the regulatory regime is moving to a Principles-Based approach rather than the current Rules-Based regime. This process has already taken some time and, although it should result in better alignment between capital requirements and risk, its effects if any on the life ILS market are unclear.

### **Other Opportunities**

While the life ILS market probably requires the catalyst of capital constraints for it to take off, opportunities are available for those with capital prepared to bet on extracting capital efficiencies to be gained from de-risking insurer balance sheets.

A number of players, including Swiss Re (through subsidiary Admin Re), Resolution Re and Goldman Sachs (through Commonwealth Annuity and Life Insurance Company in the US and Rothesay Life in the UK) are dedicating capital to buying books of life insurance business and hedging away risks, either through market instruments or reinsurance.

These firms employ innovative hybrid structures, where the most liquid (economic) risks are hedged completely and the underwriting risks are reinsured as far as can be done cost effectively. The investing firm then benefits from the resulting margins.

## Exhibit 1: Interest Rate Exposures of Largest US Insurance Firms

### Exhibit 1A: Net Assets (\$ millions)

Firm	2005	2006	2007	2008	2009
Metlife	29 101	33 798	35 179	23 734	33 498
Prudential Financial	22 763	22 892	23 457	13 422	25 729
CNA Financial Corporation	8 950	9 768	10 150	7 297	11 166
Travelers	22 303	25 135	26 616	25 319	27 415
Berkshire Hathaway	91 484	108 419	120 733	113 707	135 785
AIG	86 317	101 677	95 801	60 805	98 076
<b>Average</b>	<b>43 486</b>	<b>50 282</b>	<b>51 989</b>	<b>40 714</b>	<b>55 278</b>
<b>Average (excl AIG)</b>	<b>34 920</b>	<b>40 002</b>	<b>43 227</b>	<b>36 696</b>	<b>46 719</b>

### Exhibit 1B: Impact on Net Assets of Modelled Interest Rate Increase (\$ millions)

Firm	2005	2006	2007	2008	2009
Metlife	-5 576	-6 000	-5 188	-4 699	-4 057
Prudential Financial	-10 391	-10 817	-10 402	-10 499	-11 967
CNA Financial Corporation	-1 946	-1 916	-2 001	-1 964	-2 213
Travelers	-2 200	-2 300	-2 500	-2 480	-2 340
Berkshire Hathaway	-2 023	-3 354	-3 875	-4 478	-4 552
AIG	-6 099	-4 577	-4 383	-23 500	-26 200
<b>Average</b>	<b>-4 706</b>	<b>-4 827</b>	<b>-4 725</b>	<b>-7 937</b>	<b>-8 555</b>
<b>Average (excl AIG)</b>	<b>-4 427</b>	<b>-4 877</b>	<b>-4 793</b>	<b>-4 824</b>	<b>-5 026</b>

### Exhibit 1C: : Impact on Net Assets of Modelled Interest Rate Increase (%)

Firm	2005	2006	2007	2008	2009
Metlife	-19.16%	-17.75%	-14.75%	-19.80%	-12.11%
Prudential Financial	-45.65%	-47.25%	-44.34%	-78.22%	-46.51%
CNA Financial Corporation	-21.74%	-19.62%	-19.71%	-26.92%	-19.82%
Travelers	-9.86%	-9.15%	-9.39%	-9.80%	-8.54%
Berkshire Hathaway	-2.21%	-3.09%	-3.21%	-3.94%	-3.35%
AIG	-7.07%	-4.50%	-4.58%	-38.65%	-26.71%
<b>Average</b>	<b>-17.62%</b>	<b>-16.89%</b>	<b>-16.00%</b>	<b>-29.55%</b>	<b>-19.51%</b>
<b>Average (excl AIG)</b>	<b>-19.73%</b>	<b>-19.37%</b>	<b>-18.28%</b>	<b>-27.73%</b>	<b>-18.07%</b>

Sources for data in Exhibit 1: See Exhibit 2

## **Exhibit 2: Data Methodology**

The firms in the sample were selected to represent the largest players by assets in the life and property/casualty markets in the US, as reported by 2010 Best's Aggregates and Averages.

The data reported was obtained from the 10-K Securities and Exchange Commission filings of the firms in question<sup>13</sup>. The data relates to the listed holding corporation in each case, which does not correspond legally to the insurance entity in all cases.

In terms of rankings:

- Metlife, Prudential Financial and AIG are ranked 1, 2 and 3 respectively for the life industry.
- Berkshire Hathaway, AIG, Travelers and CNA Financial Corporation are ranked 1, 3, 4 and 6 respectively for the property/casualty industry.
- The firms ranked 2 (State Farm) and 5 (Liberty Mutual) in the property/casualty industry are mutual firms that are not required to file 10-K returns.

The scenario modelled was a 100 basis point increase of the yield curve across every duration, with two important exceptions. Metlife uses a 10% increase in interest rates consistently each year, while AIG made use of a VAR methodology<sup>14</sup> for years 2005-2009, reverting to a 100 basis point increase in 2008 and 2009.

Furthermore, the reported impacts are generally on financial instruments only and there may be effects elsewhere on the balance sheet that are not accounted for.

Finally, it should be noted that Berkshire Hathaway is highly diversified across industries and may not be a reasonable comparison for the other firms which are focused on the insurance business.

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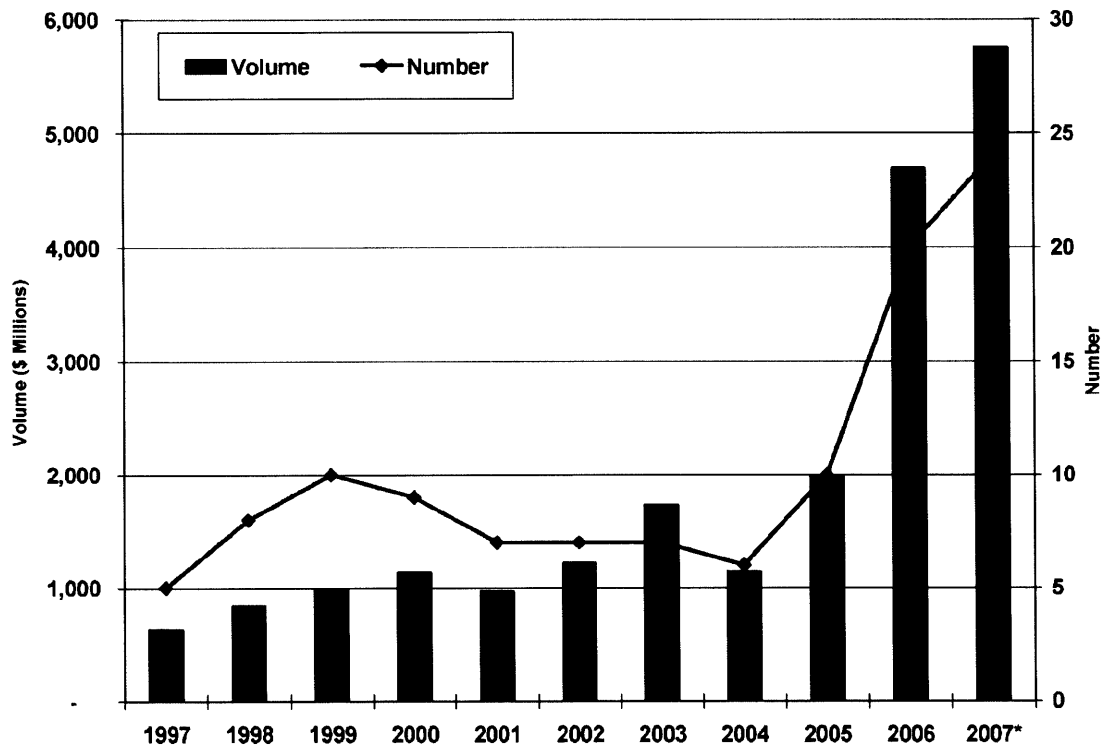
<sup>13</sup> Obtained from [www.metlife.com](http://www.metlife.com), [www.prudential.com](http://www.prudential.com), [www.cna.com](http://www.cna.com), [www.travelers.com](http://www.travelers.com), [www.berkshirehathaway.com](http://www.berkshirehathaway.com) and [www.aig.com](http://www.aig.com).

<sup>14</sup> Estimating maximum loss with 95% confidence over a 1 month horizon

Since the scenarios are not consistent between firms, the average needs to be interpreted with care. The trends are more important than the absolute numbers. Due to the inconsistency of AIG's methodology the average is also given excluding those data points.

### Exhibit 3

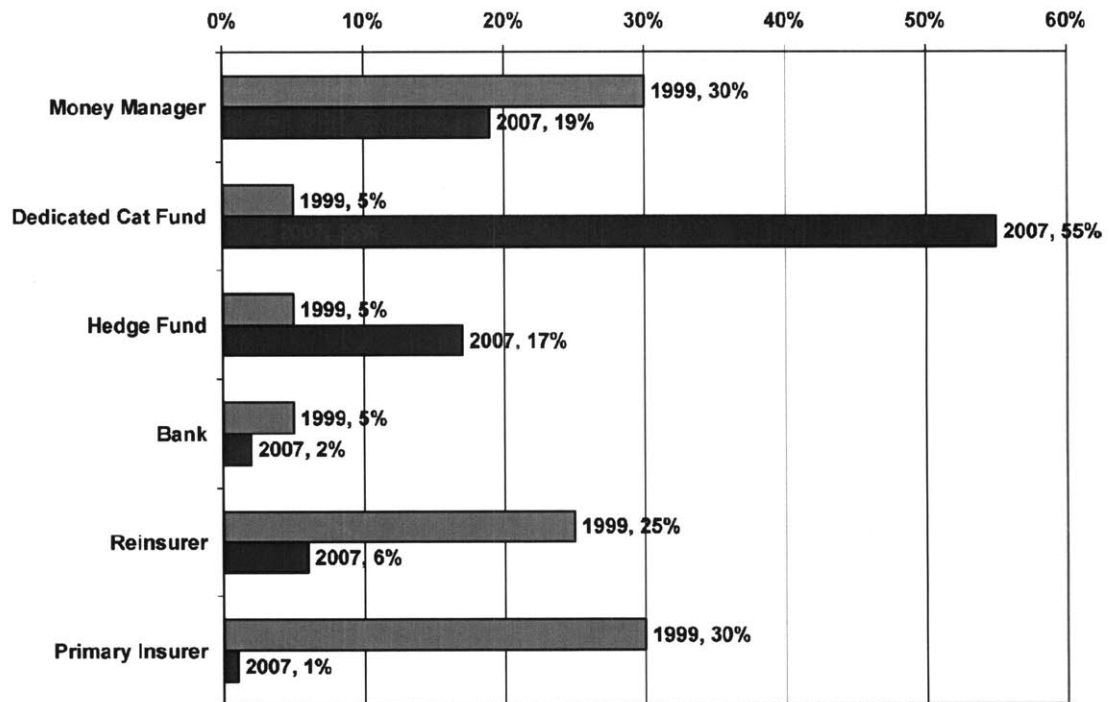
#### Catastrophe Bond Issues



\*Through July 31, 2007.  
Source: Cummins (2008)

## Exhibit 4

### Investors in Catastrophe Bond Issues



Source: Cummins (2008)

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